



T3 Mux M13 Multiplexer

User Manual

Date: June 2011

Version: 1.01

Revision History

Document Revision	Date	Description of Changes
1.01	June 2011	Initial revision of the document.

Conventions

This font indicates screen menus and parameters.

<> indicates keyboard keys (<Enter>, <q>, <s>).

NOTE

Notes inform the user of additional but essential information or features.

CAUTION

Cautions inform the user of potential damage, malfunction, or disruption to equipment, software, or environment.

Sangoma Technologies provides technical support for this product.

Tech-support e-mail: techdesk@sangoma.com



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Sangoma T3Mux M13 Multiplexer User Manual

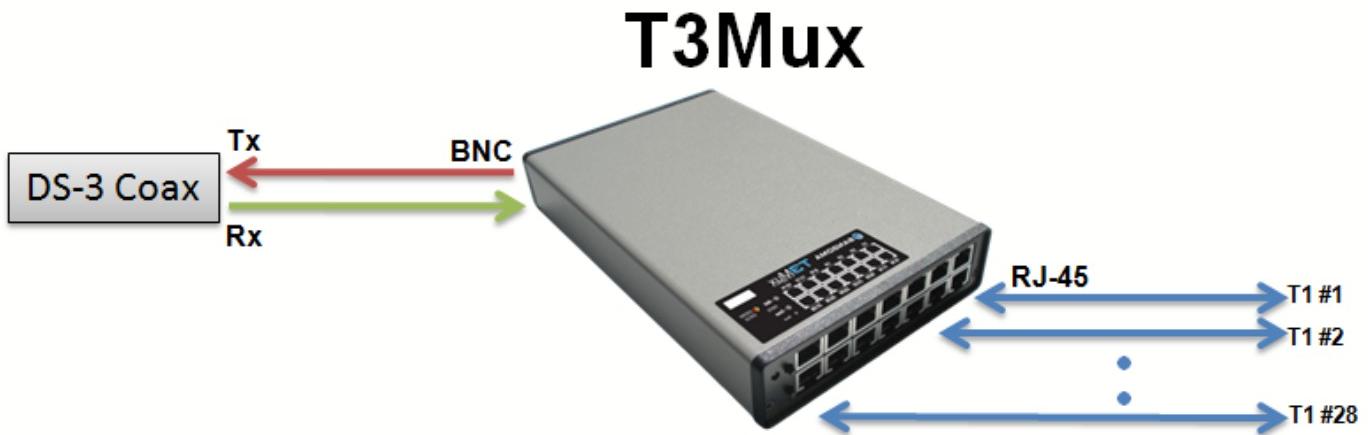
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Section 1: Product Overview

1.1 Introduction

The T3Mux is an M13 Multiplexer which takes on one side inputs from the Telco in the form of a DS3, which carries up to 45 Mbps of 64 kbps channelized voice channels and rearranges the DS-3 framing into 28 T1 framings.



The major features of the T3Mux are as follows:

- Cost-Effective DS3 bandwidth consolidation
- Simple configuration via Ethernet or RS232 using VT100 terminal menu structure
- M13 and C-bit signaling support
- External DS3 clock option

Section 2: Getting Started

2.1 Installation and Operation

The first three tasks for installing and operating the T3Mux are to unpack, inspect, and power up. Carefully inspect the T3Mux for any damage that might have occurred in shipment.

If damage is suspected, file a claim immediately with the carrier, keep the original packaging for damage verification and/or returning the unit, and contact Sangoma Customer Service.

2.2 Shipping Contents

- T3Mux unit
- 5V 2A Power Supply
- This user guide

Cables sold separately

SKU	Description
CABL-630	T1 "Portsplitter" Cable to connect T3Mux to single T1 port (A101,A102 and A104)
CABL-614G	T1 Cable to connect T3Mux to dual T1 port (A108)
TDB(Julien)	Shielded BNC Coax Cable to connect DS3 port.

2.3 Rear Panel



2.3.1 DS3 Connectors

The DSX-3 network interfaces are full-duplex circuits provided by two BNC coaxial cable connections. The receive data from the network is connected to the Rx (Input) connectors; while the transmit data from the T3Mux is connected to the Tx (Output) connectors.

2.3.2 Power Connection

The T3Mux is provided with a universal AC/DC 5V, 2A, center positive power adapter.

2.3.3 DS3 Status LED

A Green LED indicates the DS3 is Operational (no Alarms).

A Red LED indicates the DS3 is non-Operational (there are Alarms).

For a description of the Alarms, please refer to Section 3.3.1.

2.3.4 ETH Port

The ETH Port is an 8-pin RJ45 connector that provides 10/100 Base-T Ethernet LAN Interface. This LAN interface is used for Telnet control, using IP. The IP Configuration is described in details in Section 3.1.

2.3.5 RS232 Port

The RS232 port is a DB9 female connector, requiring **a straight through cable, not null modem**.

- Baud rate 115200, 8 data bits, 1 stop bit, no flow control.
- The RS232 port is used for Terminal Connection.
- The Serial connection is established using a COM Port on the host PC.

We use the term “host” to refer to the Windows computer and “target” to refer to the T3Mux equipment.

Please note that the COM Port is not available on some systems. The alternative is “USB-to-Serial” converter cable, similar to “Diablotek CA-1638 USB 2.0 to 9-Pin RS232 DB9 Serial Adapter - 2FT”.

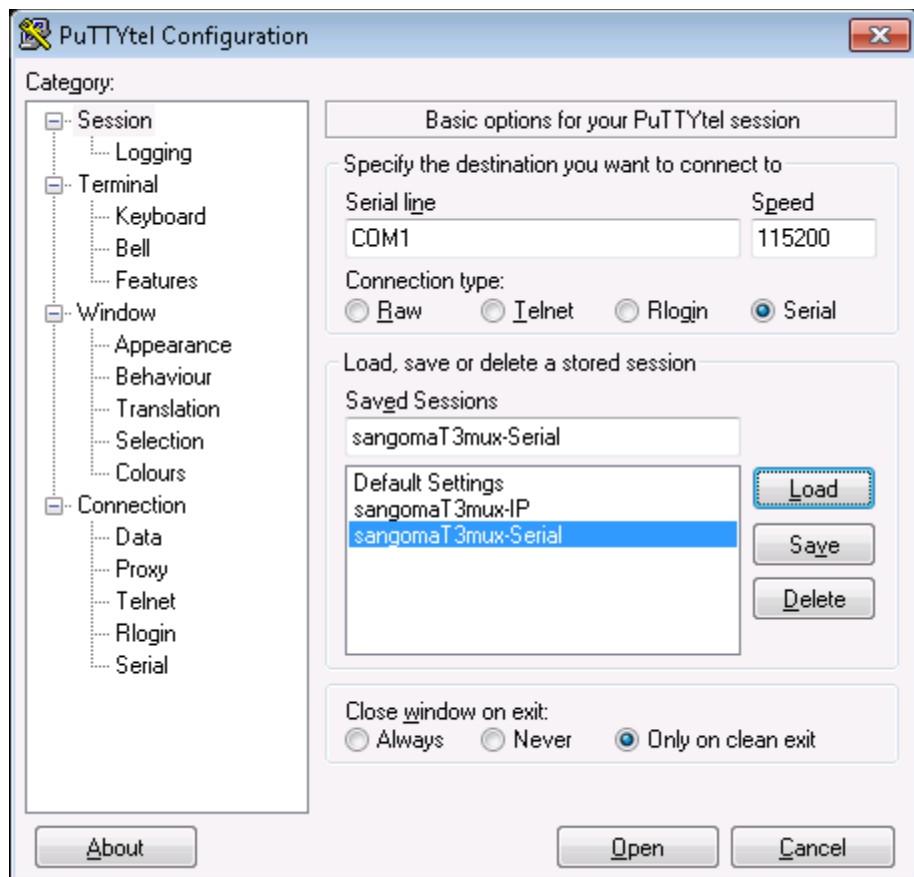
If a COM port is available on your system, please use COM1 for Serial connection. If you are using a “USB to Serial” converter cable to connect serial cable, please use COM3. If none of the above situation, you need use the correct COM port that the host is connecting to T3Mux.

The next step is to set configuration of the COM Port in the Windows Device Manager: In the COM1 (or COM3, or other port) Properties window, choose 9600 for the Bits per second. Choose 8 for Data bits. Choose None for Parity. Choose 1 for Stop bits, and None for Flow control. Then click OK;

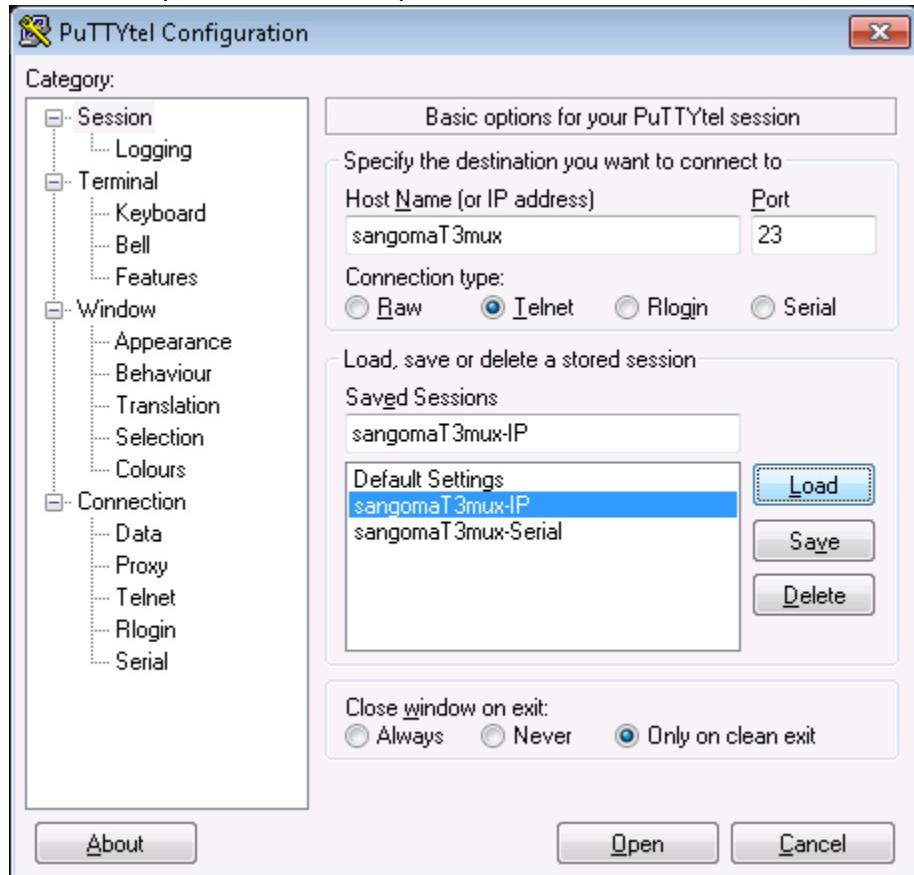
2.3.6 Establishing Terminal Connection.

To connect T3Mux to a VT100 terminal (over Serial cable), follow this procedure:

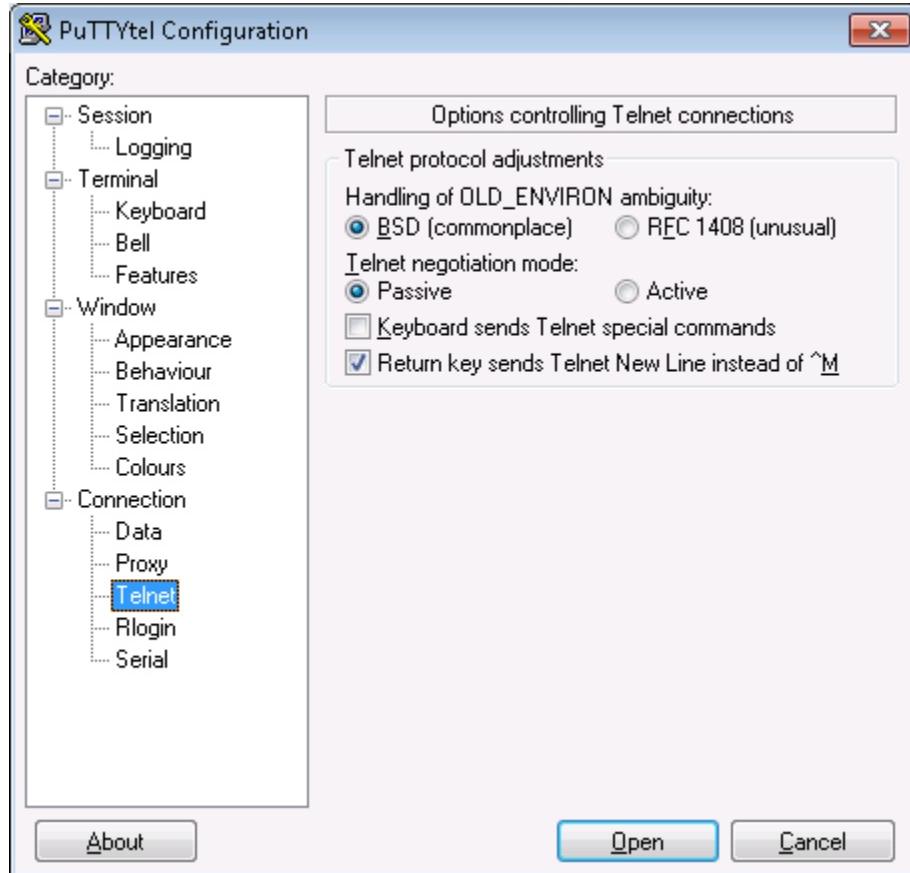
1. Download PuttyTel.exe from: <ftp://ftp.sangoma.com/T3Mux/puttytel.exe>
2. Start PuttyTel.exe on your Windows PC.
3. Select Serial port settings as shown on this screenshot:
4. Initialize the terminal session by clicking on “Open” button.
5. Press <Enter> repeatedly until the “Main Menu” appears.
6. Refer to **Section 3** for description of the Menu-driven user interface.



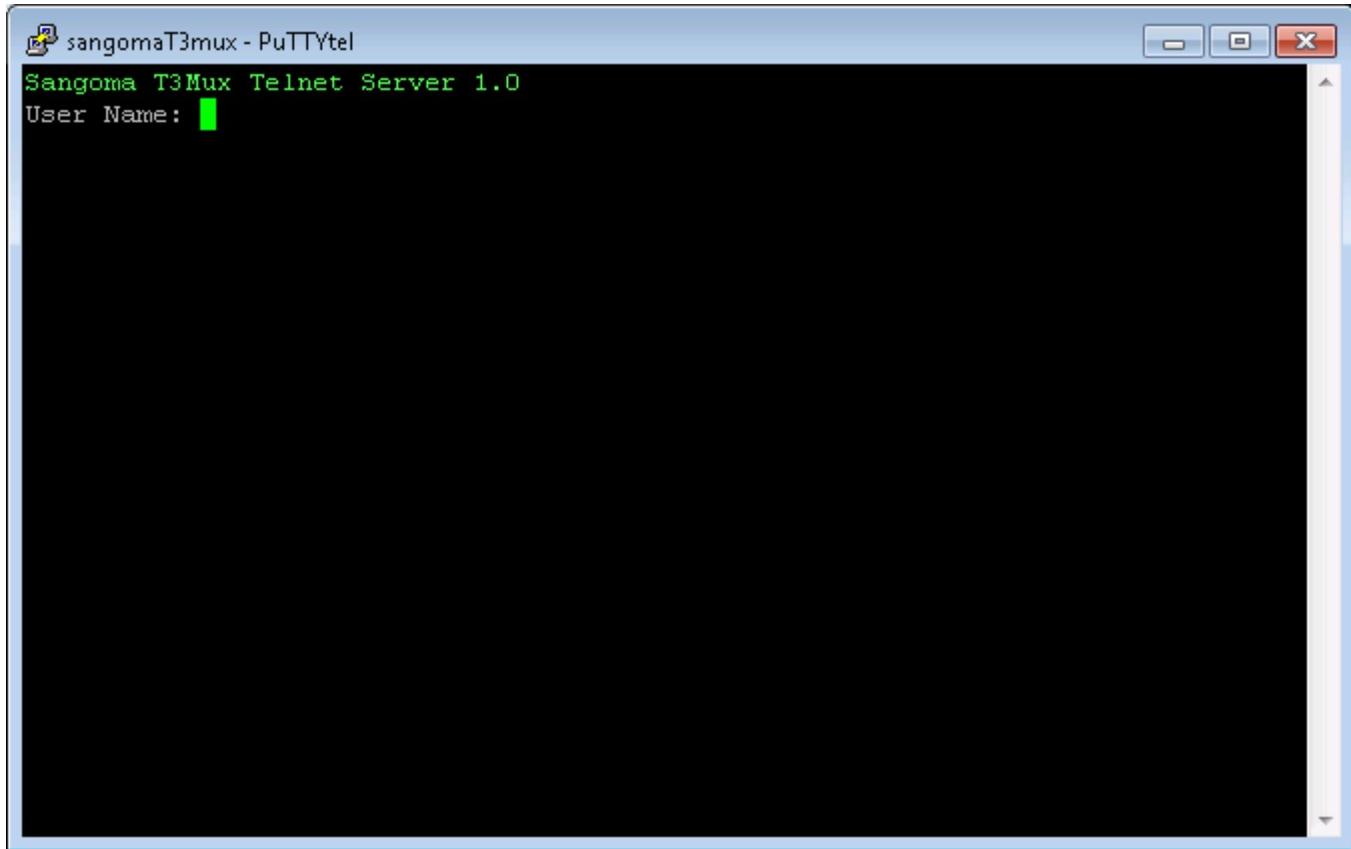
Alternatively, T3Mux can accept Telnet connections over TCP/IP:



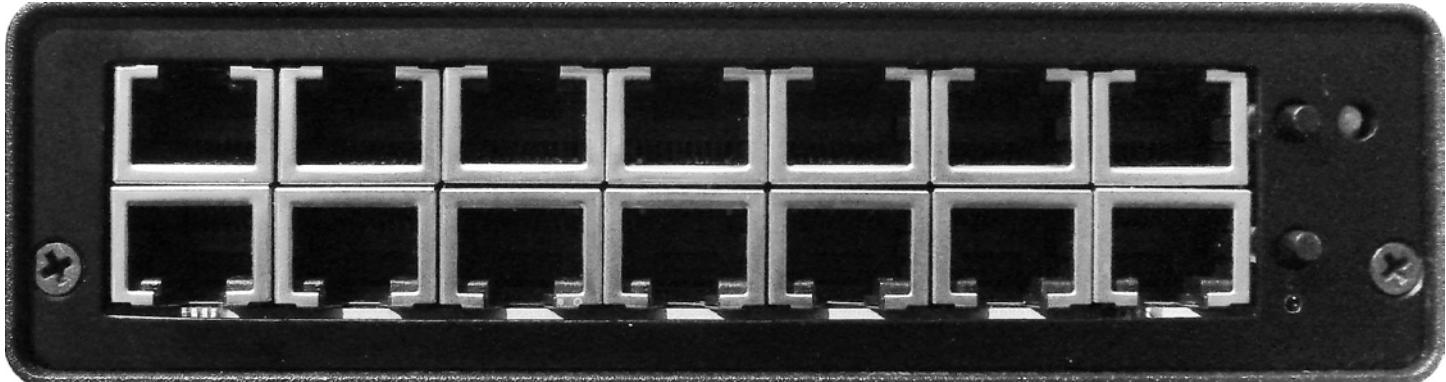
It is important to select “Passive Telnet negotiation mode” in “Connection->Telnet”:



Once the configuration options are selected, please click “Open”, you should see the Login prompt of the Telnet Server:



2.4 Front Panel



With its label adhered at the top of the device to describe the interface:



2.4.1 DS1 Connectors

The T1 Connectors are RJ48. There are two T1 ports per connector, each in a DSX pinout.

1. A straight through cable (CABL-614G) can be used to connect directly to CSU/DSU boards such as Sangoma's A108DE.
2. A split cable (CABL-630) should be used to connect Sangoma's other T1/E1 boards such as the (A101D, A102D, A104D).

Pinouts:

Pin1 = TRING_N	Pin 5 = RTIP_N
Pin2 = TTIP_N	Pin6 = TTIP_N+1
Pin3 = TRING_N+1	Pin7 = RRING_N+1
Pin4 = RRING_N	Pin8 = RTIP_N+1

2.4.2 Push-Buttons

The Push-Button marked as “Odd” will command the T3Mux to display status of odd-numbered: T1 Ports in the range of 1 – 27.

The Push-Button marked as “Even” will command the T3Mux to display status of even-numbered: T1 Ports in the range of 2 – 28.

The Status of a Port is shown as Green when the T1 line is Operational (no Alarms).

The Status of a Port is shown as Red when the T1 line is non-Operational (there are Alarms).

To find out what are the Alarms, please refer to Section **3.2.1**.

2.4.3 System Status LED

The LED is Red when the at least one of following conditions is true:

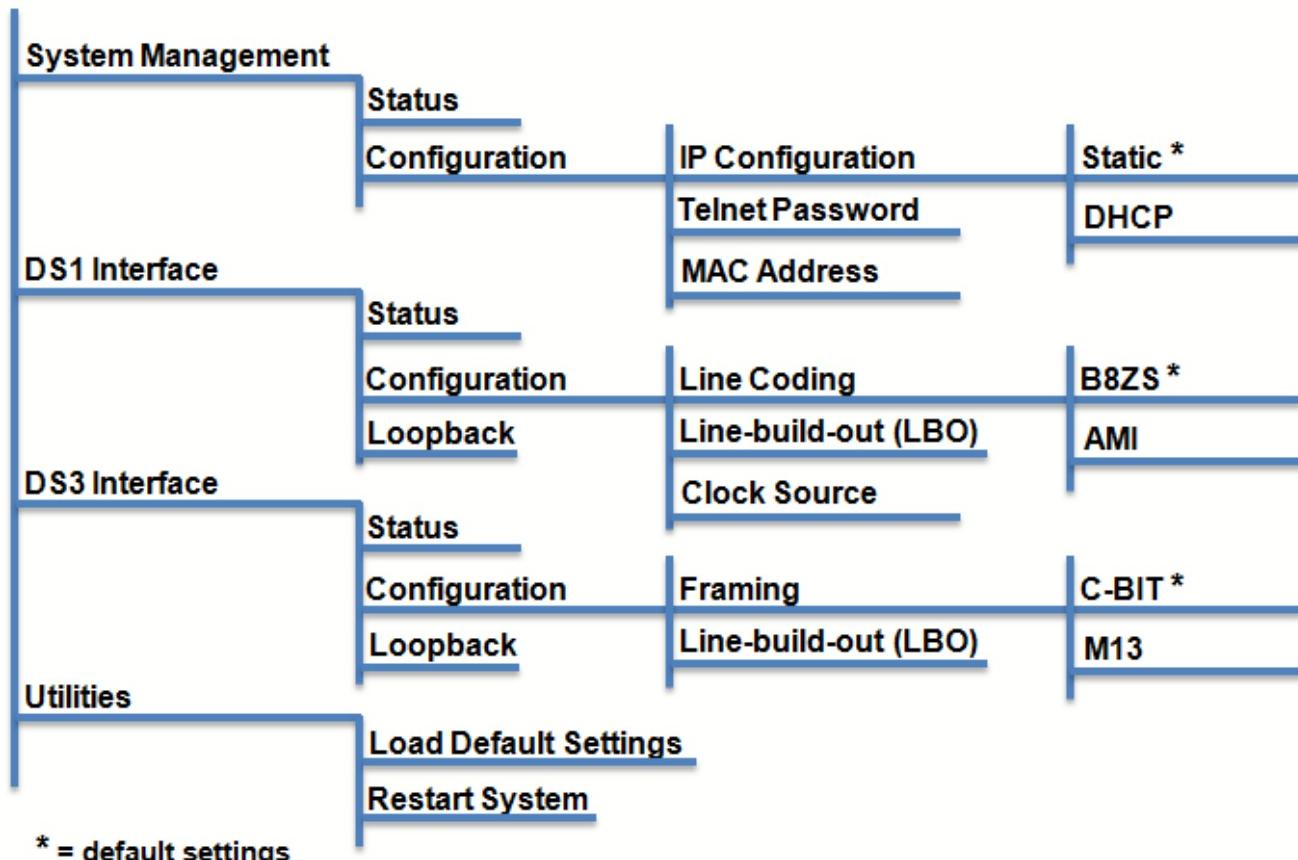
1. There is internal system error, and the T3Mux is not fully operational in some way.
2. There is an Alarm on DS3 circuit.

In all other situations the LED is Green.

Section 3 : User Interface

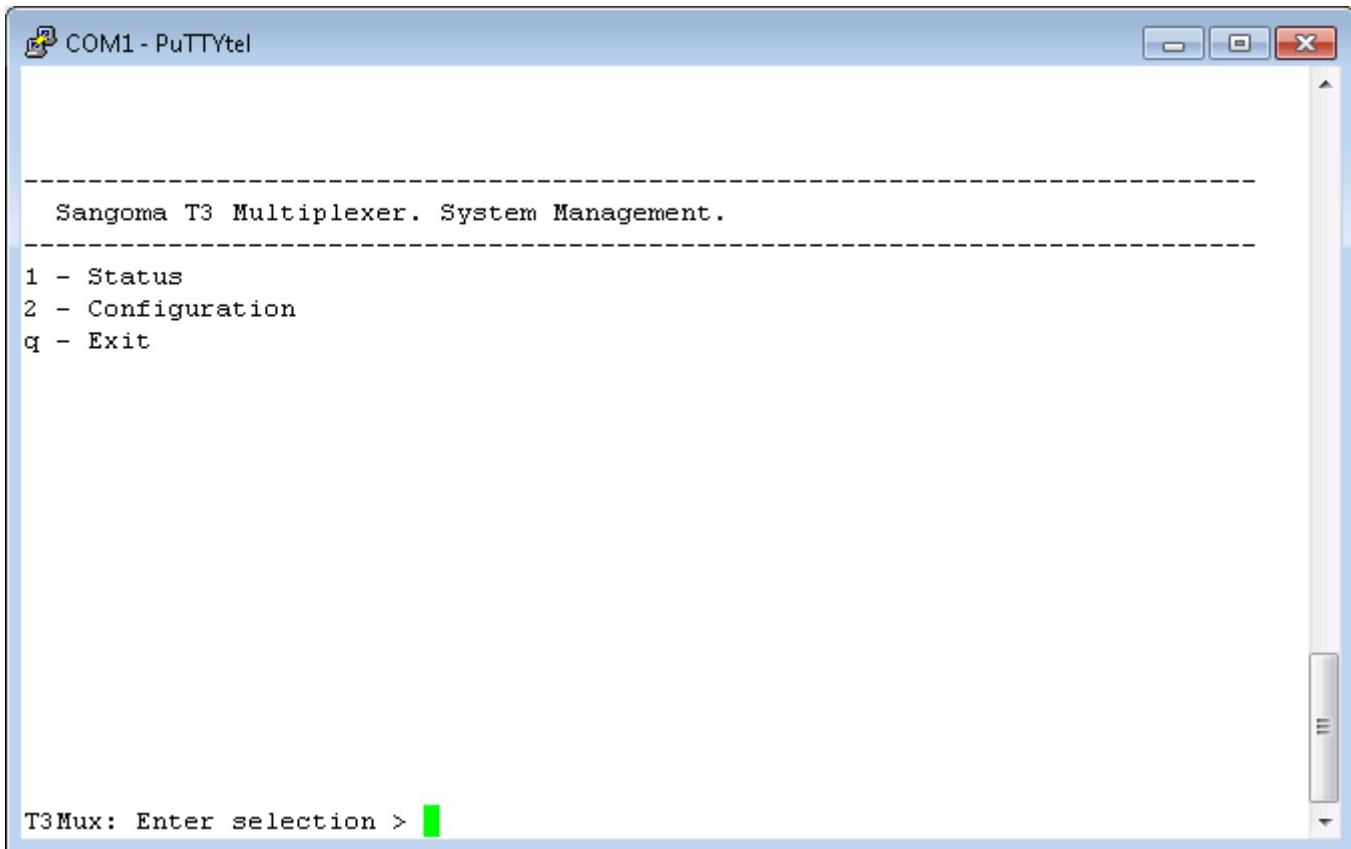
This section describes the Menu-driven user interface of the T3Mux.

Here is the structure of Menu tree:



3.1 System Management

The System Management menu:



COM1 - PuTTYtel

Sangoma T3 Multiplexer. System Management.

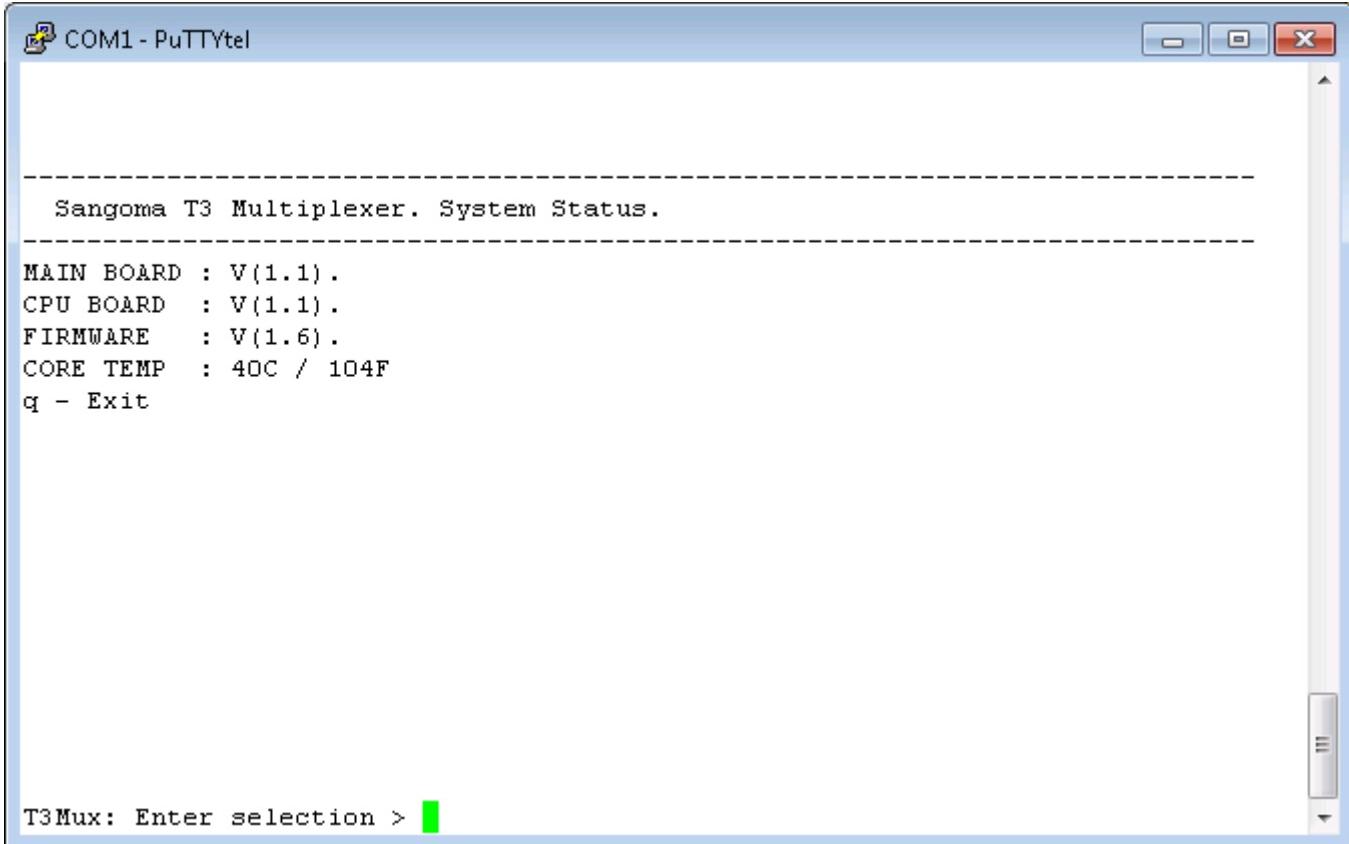
1 - Status
2 - Configuration
q - Exit

T3Mux: Enter selection > []

Used to view system status and change system configuration.

3.1.1 System Status

The System Status screen:



COM1 - PuTTYtel

```
Sangoma T3 Multiplexer. System Status.  
-----  
MAIN BOARD : V(1.1).  
CPU BOARD  : V(1.1).  
FIRMWARE   : V(1.6).  
CORE TEMP  : 40C / 104F  
q - Exit  
  
T3Mux: Enter selection > [ ]
```

A screenshot of a Windows-style terminal window titled "COM1 - PuTTYtel". The window displays system status information for a Sangoma T3 Multiplexer. The text output is as follows:

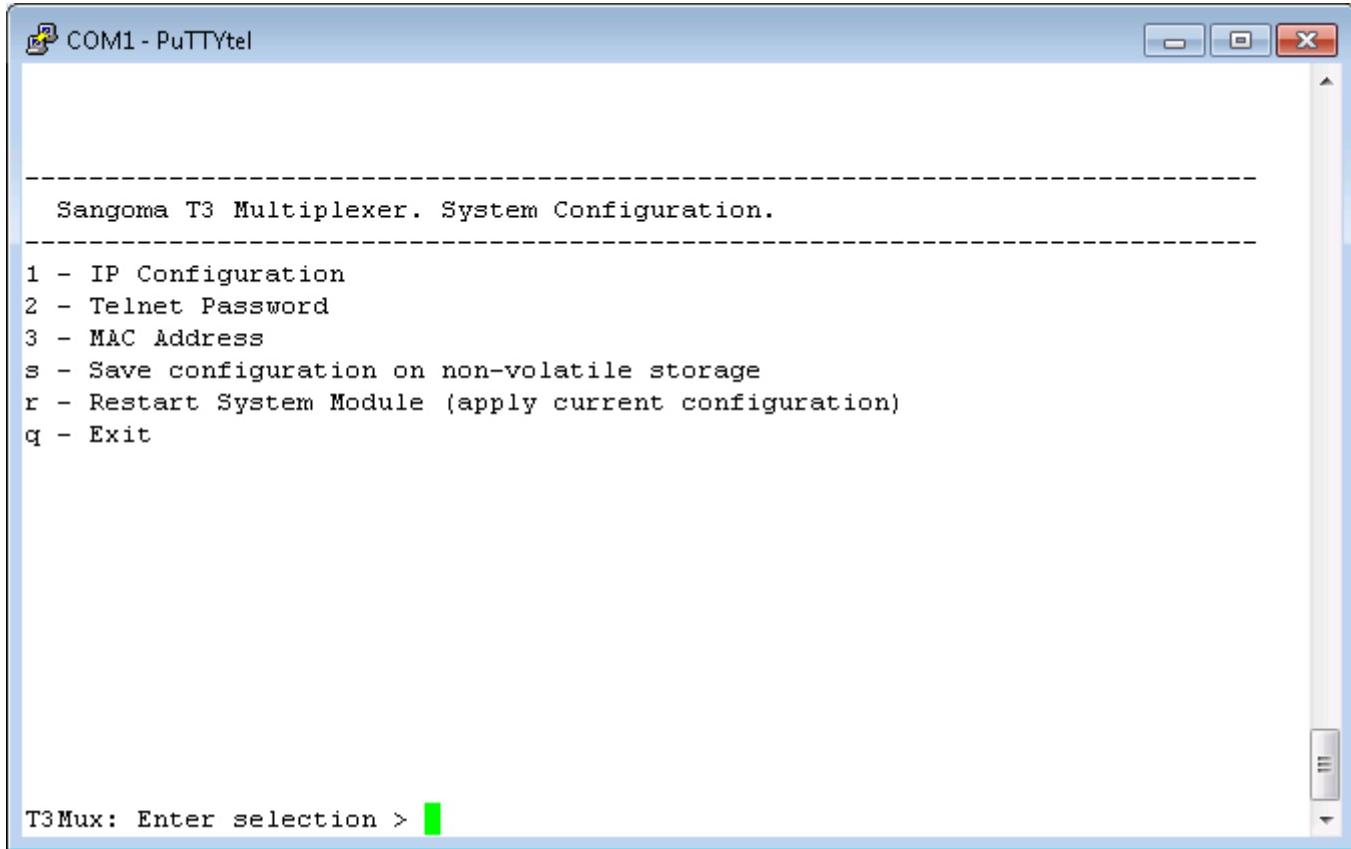
MAIN BOARD : V(1.1).
CPU BOARD : V(1.1).
FIRMWARE : V(1.6).
CORE TEMP : 40C / 104F
q - Exit

T3Mux: Enter selection > []
The window has standard operating system controls (minimize, maximize, close) at the top right and a vertical scroll bar on the right side.

Displays version and temperature information which is important for technical support personnel.

3.1.2 System Configuration

The System Configuration menu:



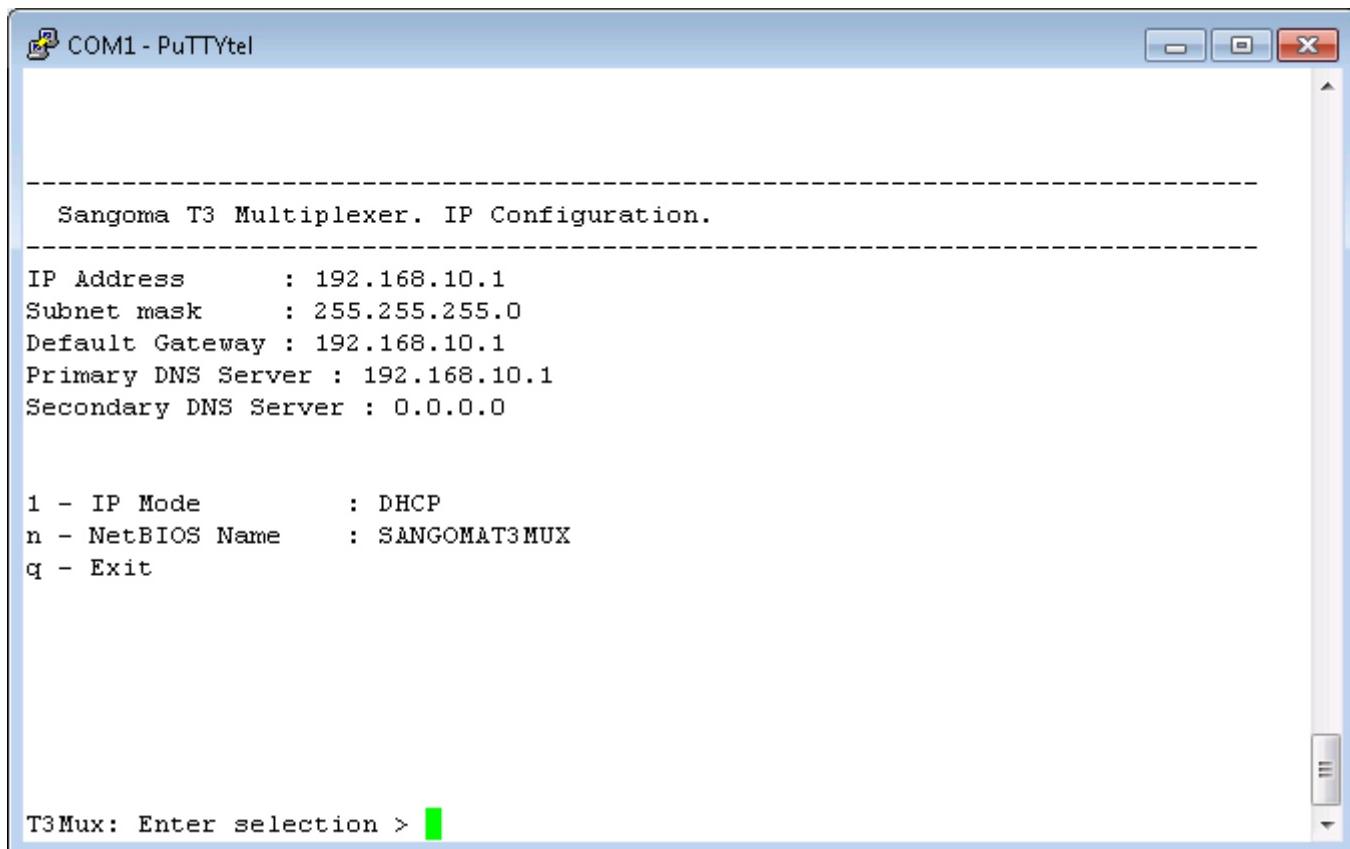
```
-----  
Sangoma T3 Multiplexer. System Configuration.  
-----  
1 - IP Configuration  
2 - Telnet Password  
3 - MAC Address  
s - Save configuration on non-volatile storage  
r - Restart System Module (apply current configuration)  
q - Exit  
  
T3Mux: Enter selection > [ ]
```

Used to set IP Configuration, Telnet Password and MAC Address for the LAN Connection.

The default user name for LAN Connection is “admin”, password “sangoma”.

The RS232 Connection does not require user name/password.

The IP Configuration menu:



```
COM1 - PuTTYtel
-----
Sangoma T3 Multiplexer. IP Configuration.

IP Address      : 192.168.10.1
Subnet mask     : 255.255.255.0
Default Gateway : 192.168.10.1
Primary DNS Server : 192.168.10.1
Secondary DNS Server : 0.0.0.0

1 - IP Mode      : DHCP
n - NetBIOS Name : SANGOMAT3MUX
q - Exit

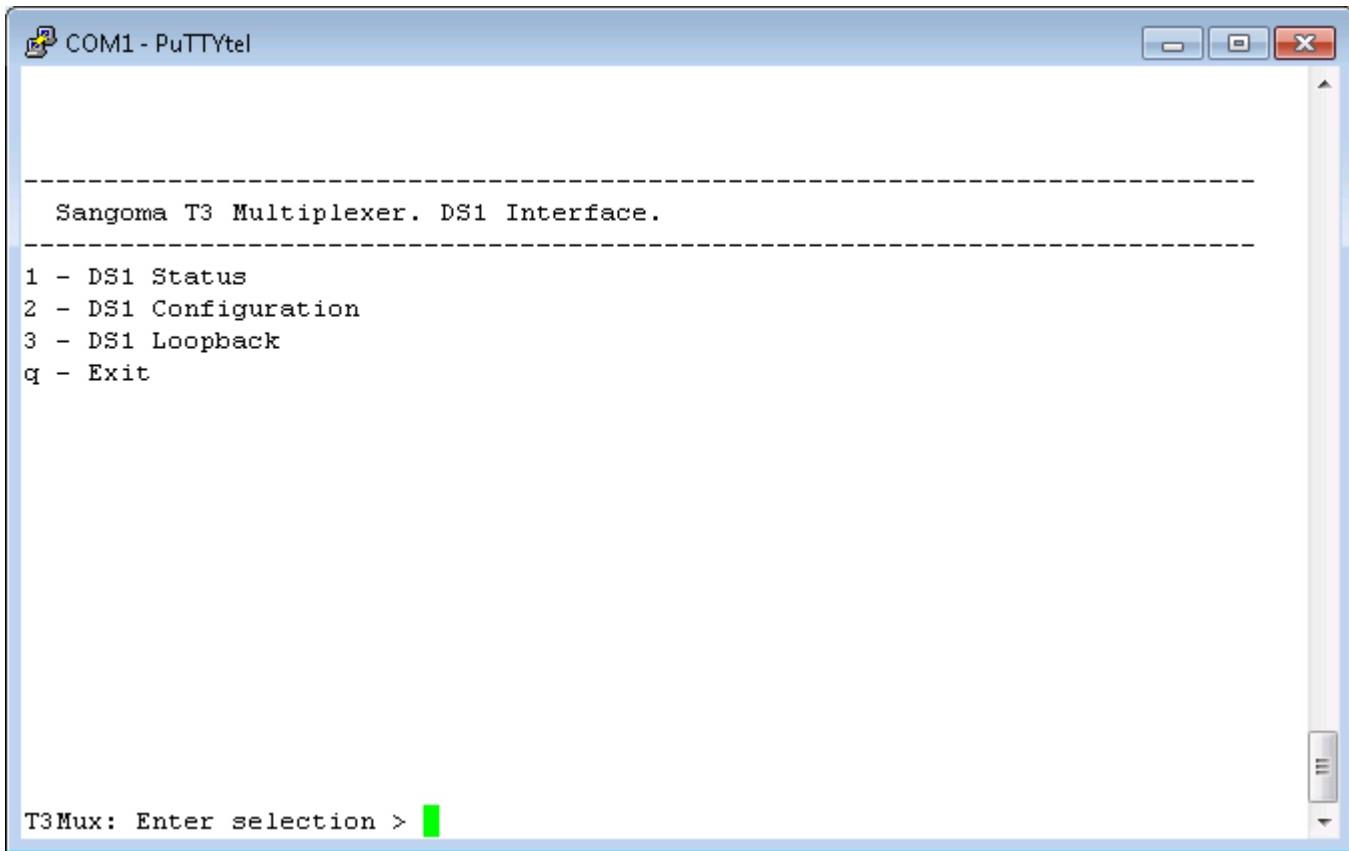
T3Mux: Enter selection > [ ]
```

Used to set IP Configuration. The options for “IP Mode” are: “Static” and “DHCP”. If Static mode is selected, the Subnet Mask, Default Gateway and Primary DNS Server will also be required.

By default, the device is configured with static IP Address of 192.168.10.1 and Net Mask of 255.255.255.0. The NetBIOS (Microsoft Networking) name for the device is SangomaT3Mux. It is possible to set a different static IP Address, or to switch to Dynamic IP addressing using DHCP.

3.2 DS1 Interface

The DS1 Interface menu:



COM1 - PuTTYtel

Sangoma T3 Multiplexer. DS1 Interface.

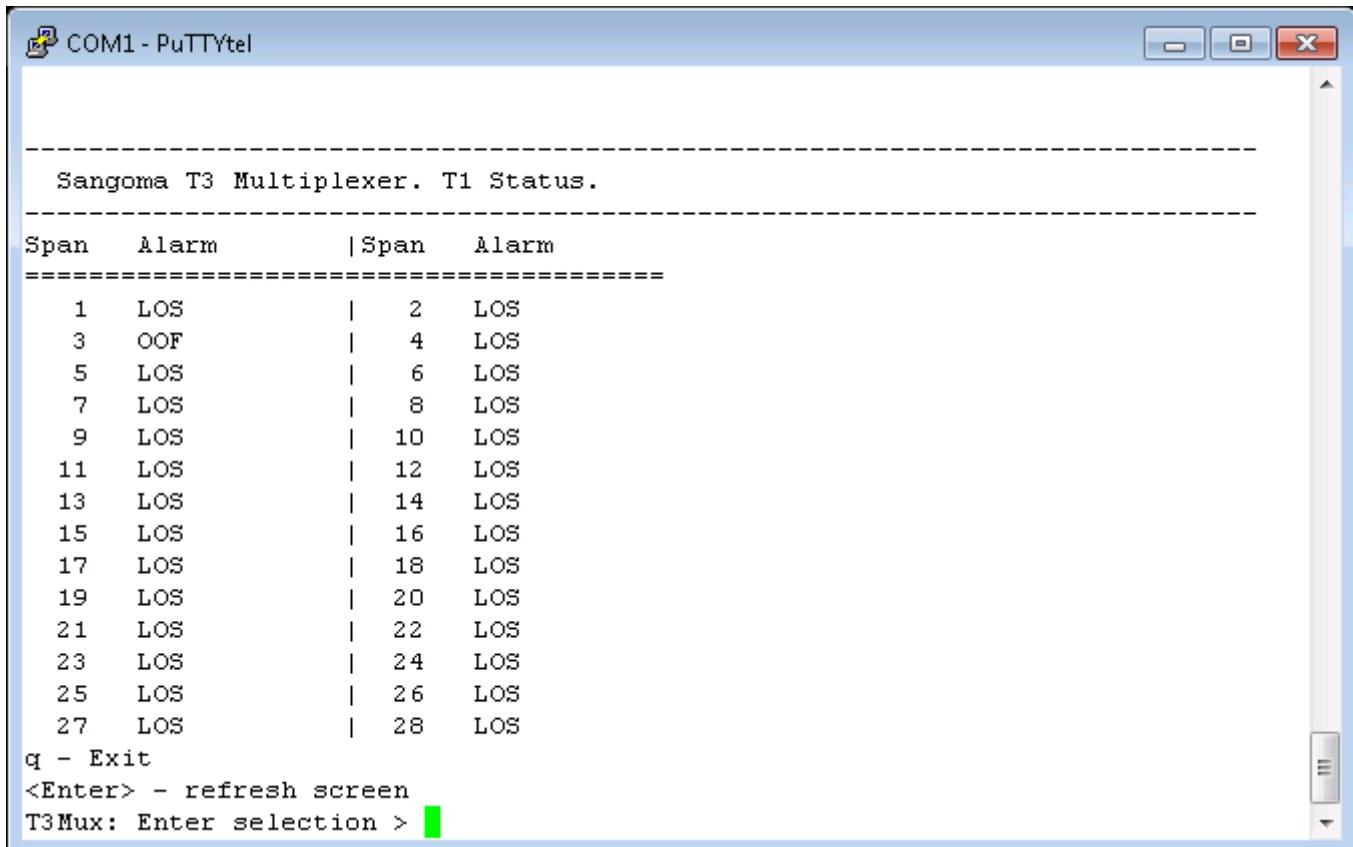
1 - DS1 Status
2 - DS1 Configuration
3 - DS1 Loopback
q - Exit

T3Mux: Enter selection > []

Used to view Status of T1 lines, configure T1 line(s) and control the T1 Loopback.

3.2.1 DS1 Status

The T1 Status screen:



The screenshot shows a terminal window titled "COM1 - PuTTYtel". The window displays the output of a command related to Sangoma T3 Multiplexer T1 status. The output is as follows:

```
Sangoma T3 Multiplexer. T1 Status.

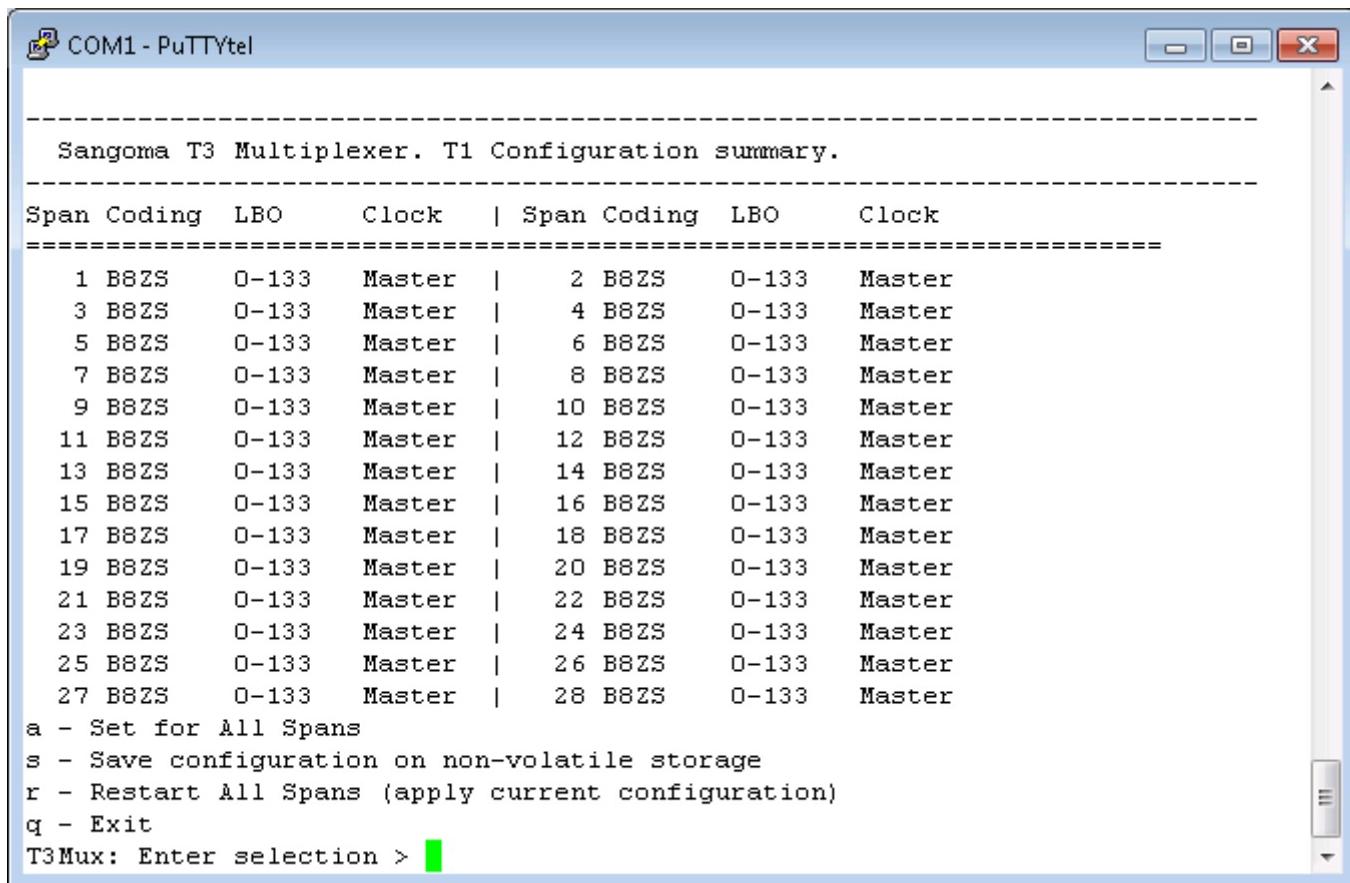
Span    Alarm          | Span    Alarm
-----+-----
  1    LOS            |  2    LOS
  3    OOF            |  4    LOS
  5    LOS            |  6    LOS
  7    LOS            |  8    LOS
  9    LOS            | 10   LOS
 11   LOS            | 12   LOS
 13   LOS            | 14   LOS
 15   LOS            | 16   LOS
 17   LOS            | 18   LOS
 19   LOS            | 20   LOS
 21   LOS            | 22   LOS
 23   LOS            | 24   LOS
 25   LOS            | 26   LOS
 27   LOS            | 28   LOS

q - Exit
<Enter> - refresh screen
T3Mux: Enter selection >
```

Displays an Alarm at T1 level. Only the highest severity alarm is shown. For example, if both LOS and OOF are present, only LOS will be shown.

3.2.2 DS1 Configuration

The T1 Configuration menu:



```

----- Sangoma T3 Multiplexer. T1 Configuration summary. -----
Span Coding LBO     Clock | Span Coding LBO     Clock
-----|-----
 1 B8ZS   0-133  Master |  2 B8ZS   0-133  Master
 3 B8ZS   0-133  Master |  4 B8ZS   0-133  Master
 5 B8ZS   0-133  Master |  6 B8ZS   0-133  Master
 7 B8ZS   0-133  Master |  8 B8ZS   0-133  Master
 9 B8ZS   0-133  Master | 10 B8ZS   0-133  Master
11 B8ZS   0-133  Master | 12 B8ZS   0-133  Master
13 B8ZS   0-133  Master | 14 B8ZS   0-133  Master
15 B8ZS   0-133  Master | 16 B8ZS   0-133  Master
17 B8ZS   0-133  Master | 18 B8ZS   0-133  Master
19 B8ZS   0-133  Master | 20 B8ZS   0-133  Master
21 B8ZS   0-133  Master | 22 B8ZS   0-133  Master
23 B8ZS   0-133  Master | 24 B8ZS   0-133  Master
25 B8ZS   0-133  Master | 26 B8ZS   0-133  Master
27 B8ZS   0-133  Master | 28 B8ZS   0-133  Master
a - Set for All Spans
s - Save configuration on non-volatile storage
r - Restart All Spans (apply current configuration)
q - Exit
T3Mux: Enter selection >
    
```

Used to set T1 Configuration.

Most of T1 Configuration Options are self-explanatory, except for the Clock option. The Clock Source options should be interpreted as follows:

“Normal” Clock – the clock is delivered from “Upstream” (from DS3 side), if the “Upstream” clock is not available, recover the Rx clock and use it for Transmission.

“Master” Clock – in case clock from “Upstream” is not available, use internal clock for Transmission.

Figure 3.2.2-1 illustrates how the T3Mux acts as a “pass-through” for T1 Master Clock coming from “Upstream”.

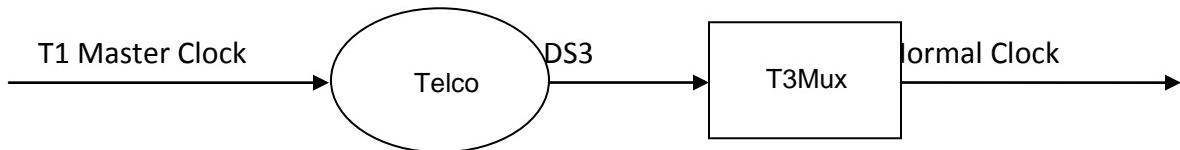
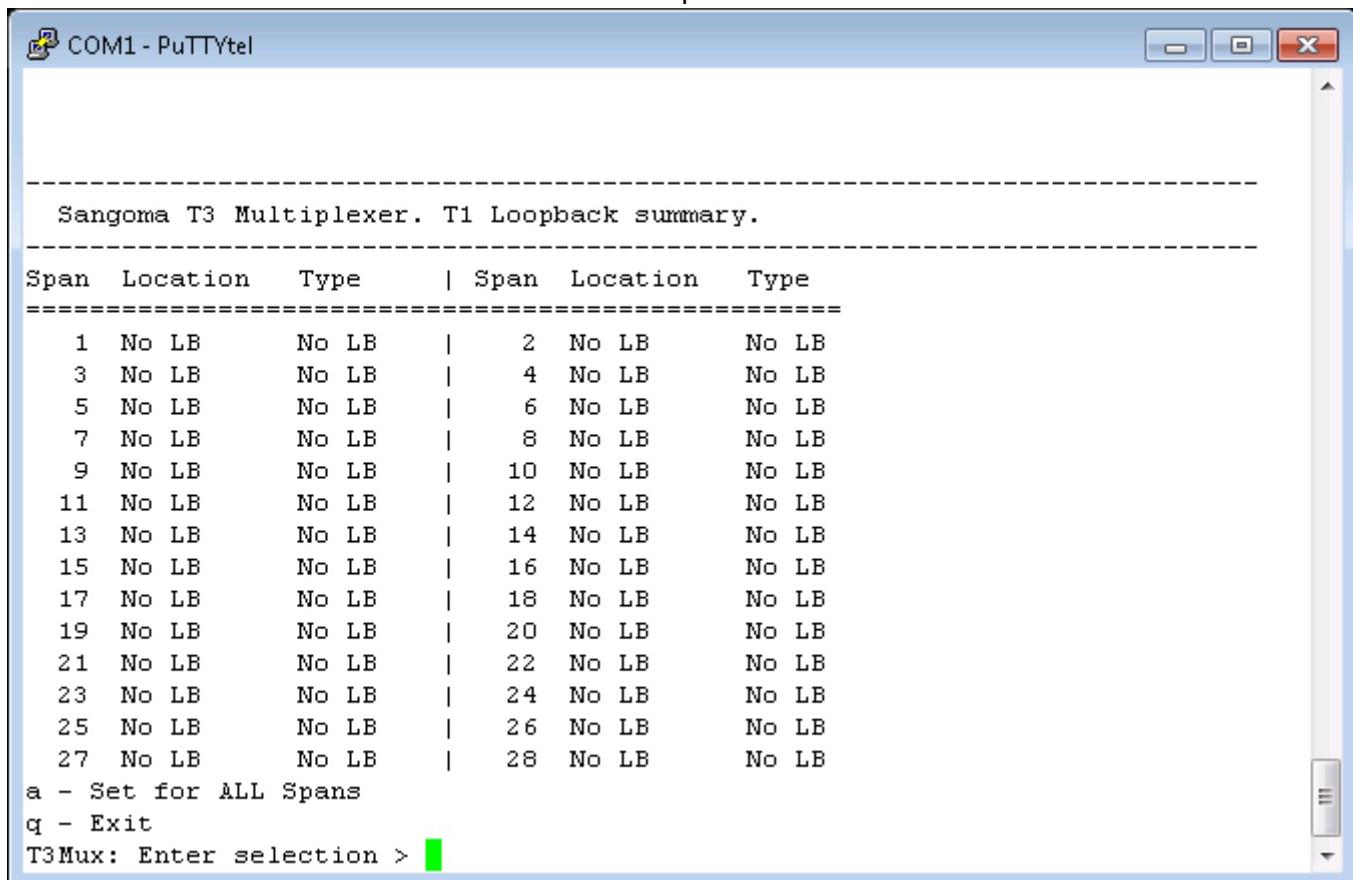


Figure 3.2.2-1.

3.2.3 DS1 Loopback

The T1 Loopback menu:



```

COM1 - PuTTYtel

-----
Sangoma T3 Multiplexer. T1 Loopback summary.

Span Location Type | Span Location Type
=====
1 No LB No LB | 2 No LB No LB
3 No LB No LB | 4 No LB No LB
5 No LB No LB | 6 No LB No LB
7 No LB No LB | 8 No LB No LB
9 No LB No LB | 10 No LB No LB
11 No LB No LB | 12 No LB No LB
13 No LB No LB | 14 No LB No LB
15 No LB No LB | 16 No LB No LB
17 No LB No LB | 18 No LB No LB
19 No LB No LB | 20 No LB No LB
21 No LB No LB | 22 No LB No LB
23 No LB No LB | 24 No LB No LB
25 No LB No LB | 26 No LB No LB
27 No LB No LB | 28 No LB No LB

a - Set for ALL Spans
q - Exit
T3Mux: Enter selection > 
    
```

Used to view and control T1 loopback:

1. Control of Local and Line Loopback in Framer (Digital Interface).
2. Control of Local and Line Loopback in LIU (Analog Interface).

When a T1 Local Loopback is enabled, all data that is output by the Transmitter will be routed to the Receiver. Local Loopback is illustrated on Figure 3.3.3-1.

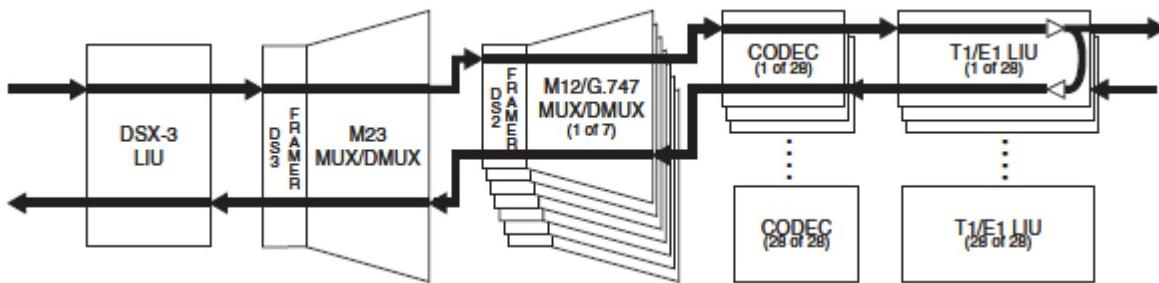


Figure 3.3.3-1.

When a T1 Line Loopback is enabled, all data that is received will be output to the Transmitter. Line Loopback is illustrated on Figure 3.3.3-2.

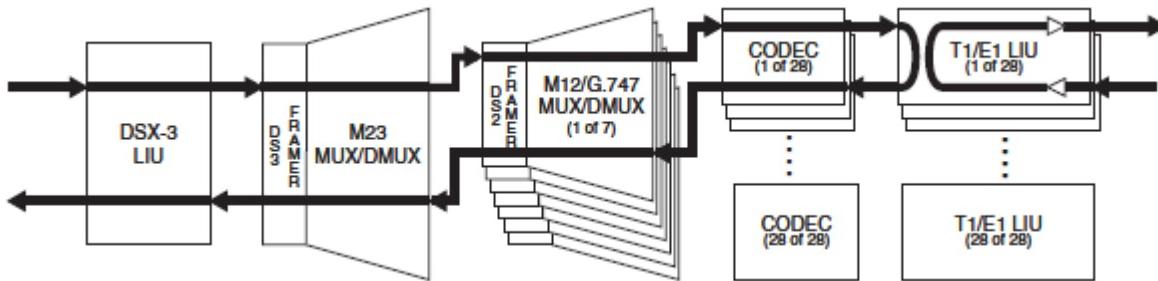
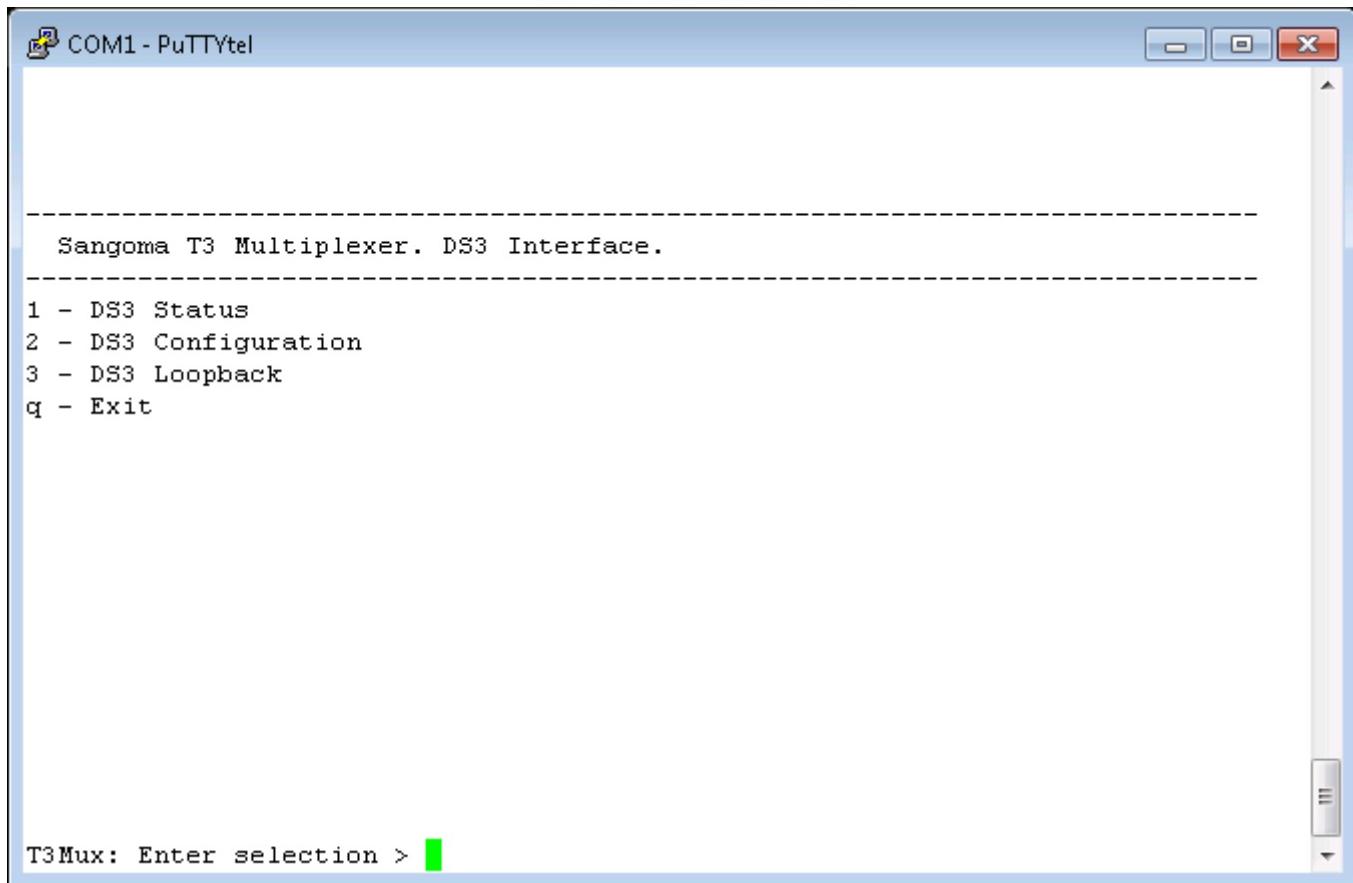


Figure 3.3.3-2.

3.3 DS3 Interface

The DS3 Interface menu:



COM1 - PuTTYtel

Sangoma T3 Multiplexer. DS3 Interface.

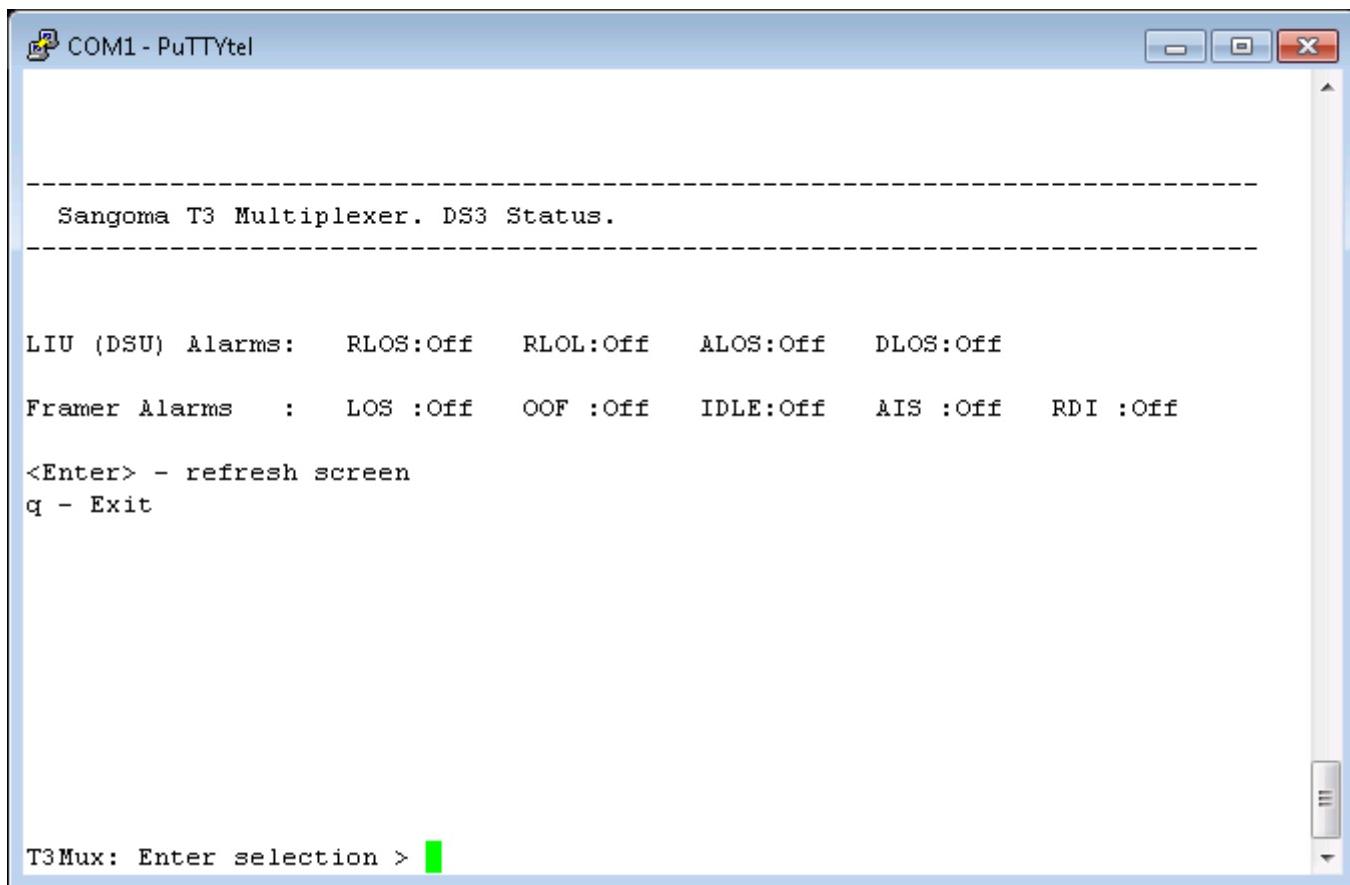
1 - DS3 Status
2 - DS3 Configuration
3 - DS3 Loopback
q - Exit

T3Mux: Enter selection > [cursor]

Used to view Status of DS3 line, configure DS3 and control the DS3 Loopback.

3.3.1 DS3 Status

The DS3 Status menu:



Sangoma T3 Multiplexer. DS3 Status.

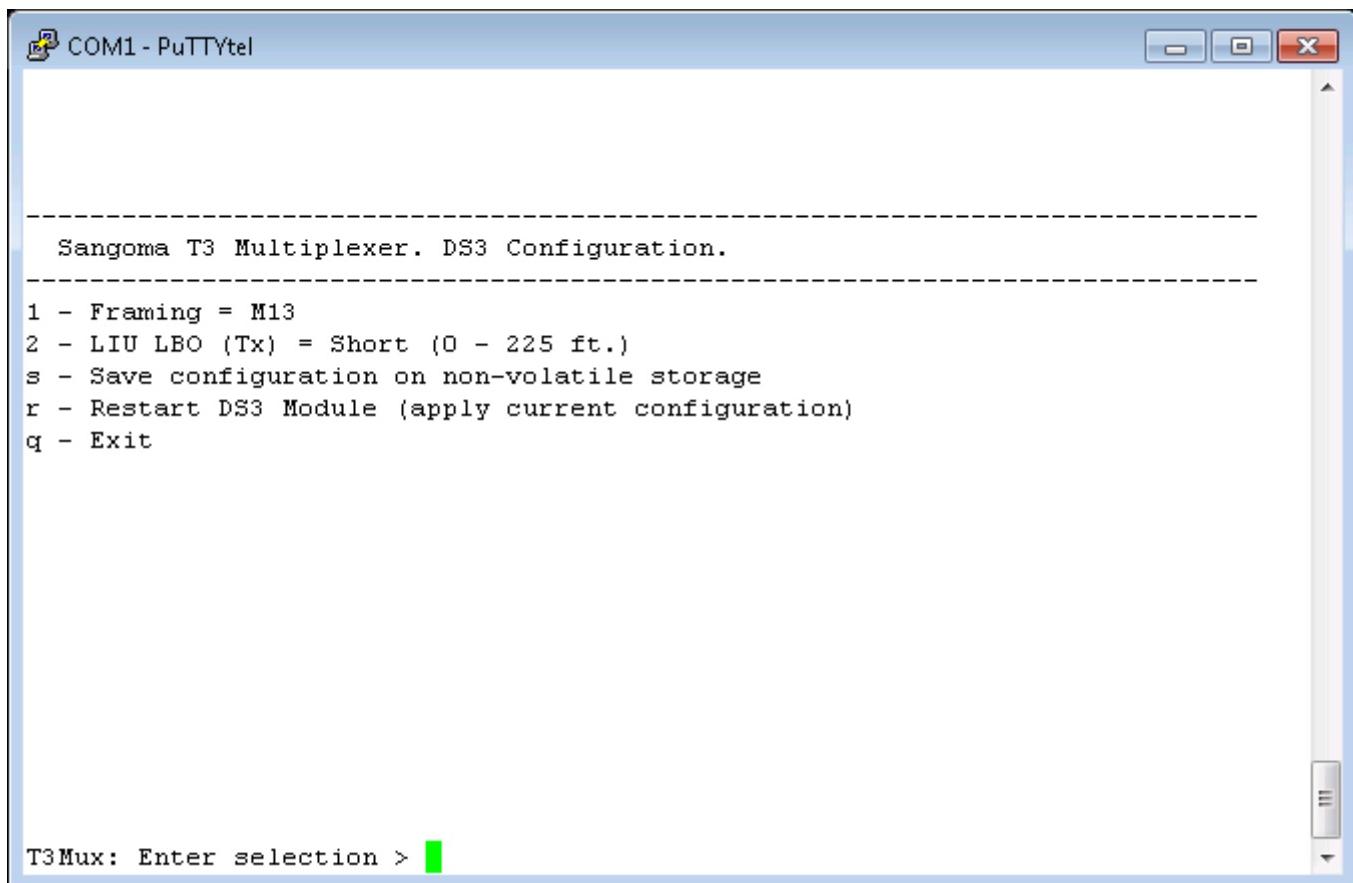
LIU (DSU) Alarms: RLOS:Off RLOL:Off ALOS:Off DLOS:Off
Framer Alarms : LOS :Off OOF :Off IDLE:Off AIS :Off RDI :Off
<Enter> - refresh screen
q - Exit

T3Mux: Enter selection > █

Used to view DS3 Alarms.

3.3.2 DS3 Configuration

The DS3 Configuration menu:

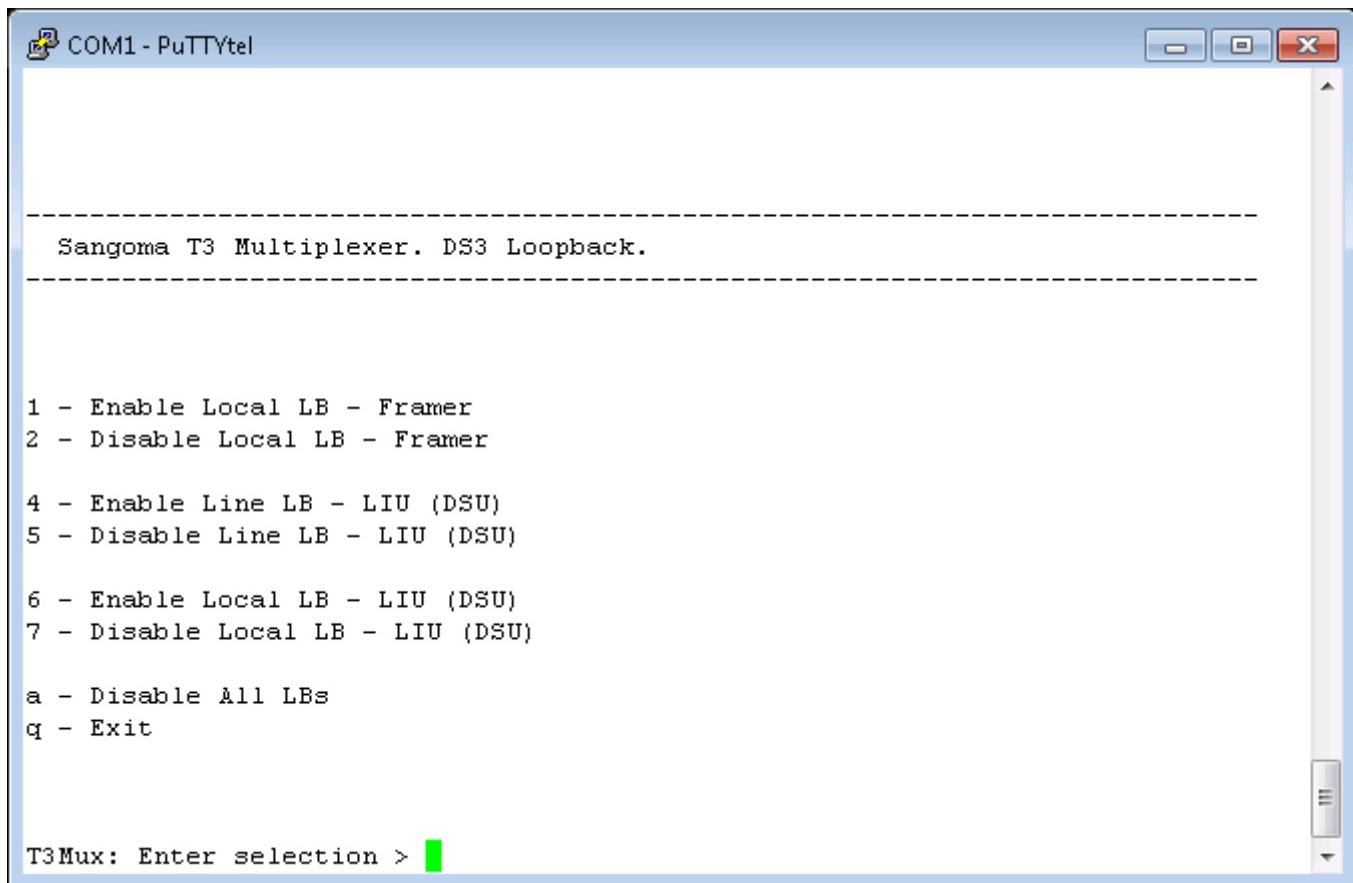


```
-----  
Sangoma T3 Multiplexer. DS3 Configuration.  
-----  
1 - Framing = M13  
2 - LIU LBO (Tx) = Short (0 - 225 ft.)  
s - Save configuration on non-volatile storage  
r - Restart DS3 Module (apply current configuration)  
q - Exit  
  
T3Mux: Enter selection > [ ]
```

Used to view/change DS3 configuration.

3.3.3 DS3 Loopback

The DS3 Loopback menu:



```
-----  
Sangoma T3 Multiplexer. DS3 Loopback.  
-----  
  
1 - Enable Local LB - Framer  
2 - Disable Local LB - Framer  
  
4 - Enable Line LB - LIU (DSU)  
5 - Disable Line LB - LIU (DSU)  
  
6 - Enable Local LB - LIU (DSU)  
7 - Disable Local LB - LIU (DSU)  
  
a - Disable All LBs  
q - Exit  
  
T3Mux: Enter selection > [ ]
```

Used to:

1. Control of Local Loopback in Framer (Digital Interface).
2. Control of Local **and** Line Loopback in LIU (Analog Interface).

When a Local Loopback is enabled, all data that is output by the Transmitter will be routed to the Receiver. Local Loopback is illustrated on Figure 3.2.3-2.

When a Line Loopback is enabled, all data that is received will be output to the Transmitter.
 Line Loopback is illustrated on Figure 3.2.3-1.

This is the diagram of DS3 Line Loopback in LIU:

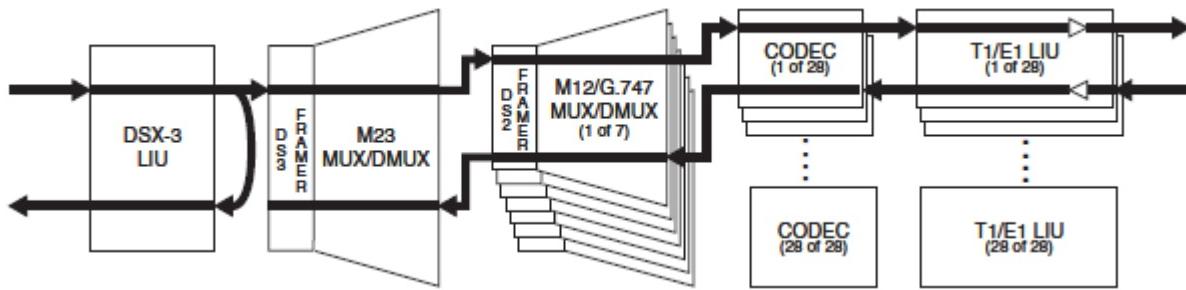


Figure 3.2.3-1.

This is the diagram of DS3 Local Loopback in Framer:

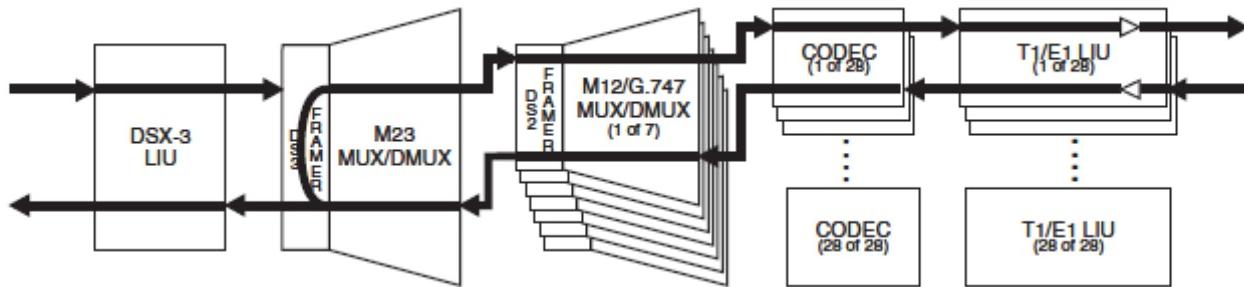
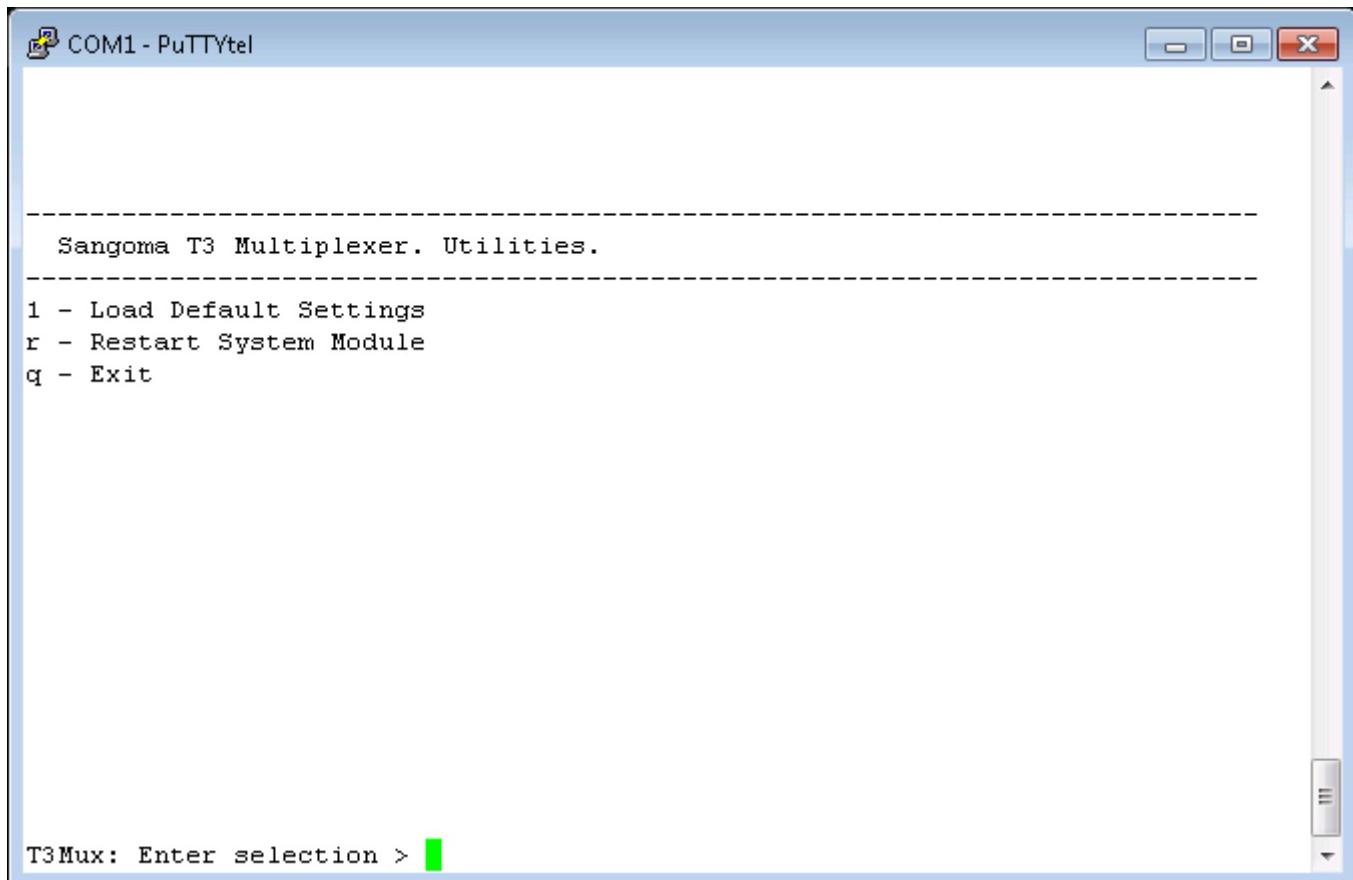


Figure 3.2.3-2.

3.4 Utilities

The Utilities menu:



Used to Restore Configuration to its default state, both in the volatile memory (RAM) and in non-volatile storage (EEPROM). The “Restart System Module” option will restart the firmware so the current settings (configuration) will take effect.

Section 4 : Maintenance

4.1 Firmware Upgrade

To upgrade T3Mux firmware, you need T3MuxUp.exe program and the firmware .eld file ready on a MS Windows host computer (we use the term “host” to refer to the MS Windows computer and “target” to refer to the T3Mux equipment).

The T3MuxUp.exe program can be downloaded from: <ftp://ftp.sangoma.com/T3Mux/T3MuxUp.exe>

Before proceeding firmware upgrade, please make sure the host and target are connected through the serial cable. Serial cable is the only way to upgrade firmware. Telnet communication is not able to complete this job.

If this is your first time connecting the target using serial port, please follow the steps in section 2.3.2 for instructions on establishing Serial connection with T3Mux. Once you are connected to the target T3Mux equipment using serial port, and you are ready for firmware upgrade.

To start updating firmware, you need to reset or reboot your T3Mux. When your T3Mux is boot up, the lights of the ports will flash about 10 seconds, run this program when the lights are flashing. You also could start Windows program first and reboot T3Mux within 60 seconds. They would establish communication and start updating firmware automatically.

To run T3MuxUp.exe, open a command line window (click Start->Run and type cmd then click Enter). Go to the firmware file’s folder (ie. \$ cd C:\Program Files\T3Mux). In the command line, type:

```
$ T3MuxUp.exe -i com1 T3Mux-1.7.1.eld
```

In the above command, “com1” is the serial port the Windows computer is actually using. “T3Mux-1.7.1.eld” is the firmware file name that you want to upgrade with. Click Enter to run the program and reboot T3Mux equipment, the upgrade will begin. When it’s finished, the upgrade program will tell it’s succeeded or failed. The upgrade may take about 4~5 minutes to complete.